CLAIMS

1. A method for detecting and treating a tumor using tissue localized volumetric impedance measurements, the method comprising:

col 60-65 5

providing an impedance measurement apparatus including an impedance sensor array having a plurality of resilient members deployable with curvature and configured to sample tissue impedance through a plurality of conductive pathways, the apparatus configured to be coupled to at least one of an energy delivery device, a power supply, a switching device or logic resources;

col 9-10 63-4

positioning the apparatus at a selected tissue site;

deploying the impedance array to define a sample volume;

utilizing the impedance array to make impedance measurements through a plurality of conductive pathways;

determining a tissue condition of the sample volume utilizing information from the impedance measurements; and

delivering energy from the energy delivery device to ablate or necrose at least a portion of the tumor.

2. The method of claim 1, wherein tissue impedance measurements through the plurality of conductive pathways are made substantially simultaneously, sequentially or sweep sequentially.

3. The method of claim 1, wherein the condition is at least one of a tumorous, a healthy, a hyperthermic, an injury, or a necrotic condition.

4. The method of claim 1, further comprising:

combining or integrating at least a first and a second impedance measurement made along a first and second conductive pathway of the plurality of conductive pathways.

Attorney Docket No.: 13724-851

5. The method of claim 1, further comprising:

identifying a tissue type utilizing information from the impedance measurements.

6. The method of claim 1, further comprising:

monitoring at least one of an ablation volume or a tumor volume at the tissue site utilizing information from the impedance measurements.

7. The method of claim 1, further comprising:

substantially simultaneously monitoring a tumor volume and a developing ablation volume at the tissue site utilizing information from the impedance measurements.

8. The method of claim 1, further comprising:

making the impedance measurements at a discrete frequency.

9. The method of claim 1, further comprising:

making the impedance measurement at a frequency distinct from an RF ablation frequency.

10. The method of claim 1, further comprising:

locating at least one of an ablation volume, an ablation boundary, a tumor volume, a tumor boundary or a healthy tissue ablative margin utilizing information from the impedance measurements.

11. The method of claim 1, further comprising:

titrating an amount of ablative treatment or energy delivery at the tissue site utilizing information from the impedance measurements.

12. The method of claim 1, further comprising:

configuring at least a portion of the plurality of conductive pathway to be substantially evenly distributed, spaced or aligned within the sample volume.

13. The method of claim 1, further comprising:

sampling an impedance within a volume defined by plurality of conductive pathways.

14. ~~The method~~ of claim 13, further comprising:

making a sweep sample of the impedance through the volume defined by plurality of conductive pathways.

15. The method of claim 1, further comprising;

repetitively sampling impedance through at least a portion of the plurality of conductive pathways to monitor for temporal changes in the tissue condition.

16. The method of claim 1, further comprising:

sampling a first impedance at a first time;

sampling a second impedance at a later second time; and

comparing the first impedance to the second impedance or comparing a tissue condition of the first time to a tissue condition of the second time.

17. The method of claim 16, further comprising:

making a treatment endpoint decision responsive to a comparison of the first impedance to the second impedance.

18. The method of claim 16, further comprising:

adjusting an ablative therapy parameter or energy delivery parameter responsive to a comparison of the first impedance to the second impedance.

19. The method of claim 1, wherein the plurality of conductive pathways defines a first and a second sample sector, the method further comprising:

sampling a first impedance within the first sample sector;

sampling a second impedance within the second sample sector; and

comparing the first impedance to the second impedance or comparing a tissue condition of the first sample sector to a tissue condition of the second sample sector.

20. The method of claim 1, wherein at least one of the plurality of conductive pathways is configured to provide a reference impedance measurement; the method further comprising: Dearlove

making a reference impedance measurement through the at least one conductive pathway.

21. The method of claim 1, wherein the plurality of conductive pathways includes a first and a second conductive pathway.

22. The method of claim 21, wherein the first and the second conductive pathways have a common origin.

23. The method of claim 21, further comprising:

positioning the second conductive pathway at a selectable angle to the first conductive pathway to define the sample volume.

24. The method of claim 21, further comprising:

sampling a first impedance through the first conductive pathway;

sampling a second impedance through the second conductive pathway; and

comparing the first impedance to the second impedance.

25. The method of claim 24, further comprising:

determining a tissue condition of the sample volume utilizing the comparison of the first to the second impedance.

26. The method of claim 1, further comprising:

measuring a complex impedance within the sample volume; and

utilizing real and imaginary components of the complex impedance to identify the tissue condition.

27. A method of detecting and treating a tumor comprising:

providing a tissue diagnosis and treatment apparatus for detecting and treating a tumor, the apparatus including an elongated delivery device, an impedance sensor array and an energy delivery device, the apparatus configured to be coupled to at least one of a power supply, logic resources or a switching device;

introducing the apparatus into a target tissue site;

making a complex impedance measurement within a sample volume substantially defined by the impedance array;

utilizing the complex impedance measurement to determine a tissue condition of the sample volume;

positioning the energy delivery at the target tissue site; and

delivering energy from the energy delivery device to ablate or necrose at least a portion of the tumor.

28. The method of claim 27, wherein the condition is at least one of a tumorous, a healthy, a hyperthermic, an injury, or a necrotic condition.

29. The method of claim 27, further comprising:

identifying a tissue type utilizing information from the complex impedance measurement.

30. The method of claim 27, further comprising:

monitoring at least one of an ablation volume or a tumor volume at the tissue site utilizing information from the complex impedance measurement.

31. The method of claim 27, further comprising:

substantially simultaneously monitoring a tumor volume and a developing ablation volume at the tissue site utilizing information from the complex impedance measurement.

32. The method of claim 27, further comprising:

making the complex impedance measurement at a discrete frequency.

33. The method of claim 27, further comprising:

making the complex impedance measurement at a frequency distinct from an RF ablation frequency.

34. The method of claim 27, further comprising:

locating at least one of an ablation volume, an ablation boundary, a tumor volume, a tumor boundary or a healthy tissue ablative margin at the tissue site utilizing information from the complex impedance measurement.

35. The method of claim 27, further comprising:

titrating an amount of ablative treatment or energy delivery at the tissue site utilizing information from the complex impedance measurement.

36. The method of claim 27, further comprising:

determining a treatment endpoint or regiment utilizing information from the complex impedance measurement.

37. The method of claim 27, further comprising:

sampling a first impedance at a first time;

sampling a second impedance at a later second time; and

comparing the first impedance to the second impedance or comparing a tissue condition of the first time to a tissue condition of the second time.

38. The method of claim 37, further comprising:

determining a treatment endpoint responsive to a comparison of the first impedance to the second impedance.

39. The method of claim 37, further comprising:

adjusting an ablative therapy parameter or energy delivery parameter responsive to a comparison of the first impedance to the second impedance.

40. The method of claim 27, further comprising:

signaling one of the tissue condition, an ablation condition or a treatment endpoint condition to one of a display, a monitoring device or an alarm.

41. The method of claim 27, further comprising:

determining a real and an imaginary component of the impedance measurement; and

utilizing at least one of the real and the imaginary components to monitor or locate at least one of the sample volume, a tumor volume or an ablation volume.

42. The method of claim 41, further comprising:

comparing the real and imaginary components of the impedance measurement to a database of real and imaginary values.

43. The method of claim 27, further comprising:

determining a magnitude and a phase angle of the impedance measurement; and

utilizing at least one of the magnitude and the phase angle to monitor or locate at least one of the sample volume, a tumor volume or an ablation volume.

44. The method of claim 43, further comprising: Kun

comparing the magnitude and the phase angle of the impedance measurement to a database of magnitude and phase angle values.

45. The method of claim 27, further comprising: Paula

determining an impedance vector within the sample volume; and

utilizing the impedance vector to monitor or locate at least one of the sample volume, a tumor volume, a tumor boundary, an ablation volume or an ablation volume boundary.

46. The method of claim 27, further comprising: Kun

determining a locus of an impedance or the complex impedance within the sample volume.

47. The method of claim 27, further comprising:

utilizing the locus to monitor, locate, image or display one of an ablation volume, a tumor volume or a tissue mass.

48. The method of claim 27, further comprising: ?

making at least two of an intracellular, extracellular or capacitance measurement within the tissue volume; and

utilizing the at least two measurements to monitor at least of the tissue volume or an ablation volume. King

49. The method of claim 27, wherein the apparatus includes logic resources, the method further comprising:

adjusting one of a power, current, power duty cycle or fluid flow response to an input from the impedance array.

50. The method of claim 27, further comprising:

making a first complex impedance measurement within a first portion of the sample volume and a second complex impedance measurement within a second portion of the sample volume; and

comparing a condition of the first sample volume portion to a condition of the second sample volume portion.

51. The method of claim 50, further comprising:

determining a distinction or boundary between the first sample volume portion and the second sample volume portion.

52. The method of claim 50, wherein the first and second impedance measurements are made substantially simultaneously.

53. The method of claim 50, wherein the first sample volume portion is one of one of an ablated or injured tissue portion and the second sample volume portion is a non-ablated or healthy tissue portion.

54. The method of claim 27, further comprising:

utilizing a reference or baseline signal to improve a signal to noise ratio sensitivity or resolution.

55. The method of claim 27, further comprising:

positioning the impedance array to detect one of a tumor volume or a boundary of the tumor volume.

56. The method of claim 27, further comprising:

processing an impedance signal using a transform function.

Attorney Docket No.: 13724-851

57. The method of claim 27, wherein the logic resources include at least one of a processor, a microprocessor, a software module, a fuzzy logic module, a database, a histological database, a tissue database or a tumor database.

58. The method of claim 27, further comprising:

generating an image of the sample volume utilizing information from at least one of the complex impedance measurement or a locus of impedance.

59. A method of detecting and treating a tumor utilizing volumetric complex impedance measurement, the method comprising:

providing a tissue diagnosis and treatment apparatus for detecting and treating a tumor, the apparatus including, an impedance sensor array, the apparatus configured to be coupled to at least one of an energy delivery device, a power supply, logic resources or a switching device;

introducing the apparatus into a target tissue site;

positioning the impedance array to define a sample volume;

making a complex impedance measurement within the sample volume; and

analyzing real and imaginary components of the complex impedance measurement to determine a tissue condition of the sample volume.

60. The method of claim 59, further comprising:

identifying a tissue type utilizing information from the complex impedance measurement.

61. The method of claim 59, further comprising:

utilizing information from the complex impedance measurement to monitor or locate at least one of an ablation volume, an ablation boundary or a tumor volume at the tissue site.

62. The method of claim 59, further comprising:

substantially simultaneously monitoring a tumor volume and a developing ablation volume at the tissue site utilizing information from the complex measurement.

63. The method of claim 59, further comprising:

titrating an amount of ablative treatment or energy delivery at the tissue site utilizing information from the complex impedance measurement.

64. The method of claim 59, wherein the impedance array includes a sensor, the sensor having one of a resistance gradient or a resistance gradient configured to improve measurement of a complex impedance.